REMARKS/ARGUMENTS

Claims 27-46 were allowed in the Office Action dated February 15, 2005 at paragraph 8 on page 9. Accordingly these claims are kept unchanged, and the following remarks do not apply to these allowed claims.

Claims 16 and 17 were indicated as being allowable at paragraph 7 on page 9 of the above-identified Office Action. Accordingly, Claims 16 and 17 have been re-written in independent form, including all limitations of base Claim 1. Note that Claims 16 and 17 are broader, after the above amendment, because the limitations of intervening Claim 12 are no longer recited therein. Claims 16 and 17 are believed to be allowable over the prior art of record, for reasons articulated by the Examiner at paragraph 7 on page 9 of the above-identified Office Action. Also, the following remarks do not apply to Claims 16 and 17.

Claims 1-15 and 18-26 were rejected over the teachings of one or more of Nonoka (US Patent 5,834,66), Crisman (5,292,195) and Lichtman (5,099,363). In rejecting the originally-filed Claim 1, the Examiner analogized Nonoka's use of "thermoplate 2" to Claim 1's application of heat.

Nonoka explicitly states at column 3, lines 10-11 that "the thermoplate 2 [is] in contact with the rear surface of the examination object 1". Nonoka further states at column 4, lines 53-55 that "the infrared camera 7 was used to obtain the surface temperature distribution from the side opposite the [thermo]plate". Therefore, Nonoka heats on one side and generates images from the opposite side of the examination object.

There is no indication whatsoever by Nonoka that his infrared camera can be used to image a single surface to which heat is also being applied. In fact, imaging of the same surface that is being heated is simply not possible in Nonoka's apparatus, at least because Nonoka's examination object "is kept in contact with the plate 2 by a load applied by a load device 9" (as per column 3, lines 32-33).

The Examiner stated in the middle of page 8 of the Office Action that "as shown by Crisman, it is known to do so, and heating the surface being viewed rather than having to heat the entire object from behind will result in a faster temperature change on the area of interest and thus speed up the measurement." Applicant respectfully traverses this statement by the Examiner. The Examiner's statement about any benefit from a faster

SILICON VALLEY
ATENT GROUP LLP

0 Mission College Blvd
Suite 360
anta Clara, CA 95054
(408) 982-8200
FAX (408) 982-8210

temperature change is directly contradicted by the explicit teachings of the primary reference by Nonoka.

Specifically, Nonoka states at column 5, lines 20-25 that detection using fast heat cycles (a) and (b) of FIG. 2 was difficult. As seen from FIG. 2 in Nonoka's Patent, heat cycles (a) and (b) involve raising the temperature from 20°C to 70°C within 15 minutes and 25 minutes respectively. Nonoka further states at column 5, lines 25-30 that use of the more gradual temperature gradients in the heat cycle (c) detected a defect portion. Nonoka's FIG. 2 shows heat cycle (c) raises the temperature from 20°C to 70°C within 35 minutes. Cooling as per Nonoka's heat cycle (c) presumably takes as much time again, i.e. another 35 minutes.

In using Nonoka's gradual heat cycle (c) as noted above, a skilled artisan would believe that each cycle takes over an hour, and hence is unlikely to repeat the heating and cooling process multiple times on the same object, to generate multiple sets of images. Claim 1 now explicitly recites that application of heat and imaging of hot and cold images are repeated multiple times in a second (for support, see specification at the bottom of page 16, top of page 29, and line 11 on page 30). By repeatedly generating images multiple times a second, Claim 1 now distinguishes over Nonoka's gradual heat cycle (c) that uses a rate which is three orders of magnitude too slow (an hour contains 3600 seconds).

Even assuming the Examiner is correct in modifying Nonoka's teachings with Crisman's teachings, Applicant submits that a skilled artisan would be led to apply Crisman's energy source 9 to the rear surface of Nonoka's object, in view of the above-described disclosure by Nonoka at column 3, lines 10-11.

Furthermore, Nonoka states that the manner of applying a thermal field and the surrounding temperature have a major influence on the temperature distribution on the surface (column 1, lines 35-40). Hence, the skilled artisan would reasonably expect success in generating the more gradual temperature gradients in Nonoka's heat cycle (c) by exposing Crisman's energy source 9 to a rear surface of the object so that the applied heat passes through the object (thereby to make the temperature gradient more gradual).

Even assuming the prior art teaches using Crisman's energy source 9 to apply heat to the same surface that is being imaged by Nonoka, there is no indication as to why the

SILICON VALLEY
ATENT GROUP LLP
0 Mission College Blvd
Suite 360
anta Clara, CA 95054
(408) 982-8200
FAX (408) 982-8210

skilled artisan would be led to have a reasonable expectation of success in applying this method to semiconductor wafers as opposed to glass fiber-reinforced plastics of the type taught by Nonoka (column 3, lines 53-54 and column 4 lines 14-16) or a pipe or a reinforced metallic structure as taught by Crisman (column 3 lines 67-68 and column 4 lines 5-6). The objects taught by these two references are significantly larger than (and have much larger defects than) semiconductor wafers of the type recited in Claim 1, and hence a skilled artisan would not look to such non-analogous art.

Moreover, even if the Examiner-proposed method is taught by the prior art for application to a semiconductor wafer, a skilled artisan on reviewing Nonoka's teachings would be led to believe that a heat-resistant black paint should be used to find defects in semiconductor wafers. This is because Nonoka states that the paint is required to detect defects smaller than 0.8 mm (see column 5 lines 42-55, and column 6 line 4).

In contrast, Claim 1 recites not only that imaging is done directly on a top surface of the semiconductor wafer (having conductive lines and vias therein) but also that heat is applied directly to the top surface. Claim 1 is amended to use the word "direct" which therefore excludes the presence of Nonoka's heat-resistant black paint. There is no indication in the combined teachings of Crisman and Nonoka that the Examiner-proposed image subtraction method effectively finds semiconductor wafer defects, without a heat-resistant black paint.

In view of the above remarks, Applicant respectfully requests the Examiner to withdraw his prior art rejection, and allow Claim 1 as amended herein. Claims 2-15 and 18-24 depend from Claim 1 and are therefore also believed to be allowable for at least the same reasons as Claim 1.

New Claim 47 depends from Claim 1 and requires a probe beam, and this claim is believed to be allowable for at least reasons similar to Claim 16.

Also, new Claim 48 depends from Claim 1, and is believed to be allowable for at least the same reasons as Claim 1. Moreover, Nonoka does not require use of a "cold" image of the type recited in Claim 48, i.e. wherein a majority of heat used to generate the hot image is dissipated from the area when the cold image is imaged. Instead, Nonoka does subtraction processing of thermal images on two gradients (heating and cooling), without stating explicitly the amount of heat to be dissipated between the images. In fact,

SILICON VALLEY
ATENT GROUP LLP

0 Mission College Blvd
Suite 360
anta Clara, CA 95054
(408) 982-8200
FAX (408) 982-8210

the images being subtracted in the example given by Nonoka are merely from two different heat gradients, namely point β on the heating gradient of cycle (c) and point γ on the cooling gradient of cycle (b). See column 5, lines 35-40). Since the two images are from two different cycles there is no suggestion by Nonoka to relate them in terms of heat dissipation. In following Nonoka's teachings, a skilled artisan wouldn't necessarily be led to use the same cycle for both images, and furthermore to wait within that one cycle, until a majority of heat is dissipated, before creating the cold image. Claim 47 is believed to be non-obvious for this reason, which is in addition to the above reasons (e.g. finding semiconductor defects without black paint etc as discussed above for Claim 1).

Moreover, Claim 25 has been amended to require a probe beam, and is therefore believed to be allowable for at least reasons similar to those for Claim 16. Also, new Claim 49 is believed to be allowable for reasons similar to Claim 16. Note that in the method of Claim 49, heat may be applied to the area being imaged in any manner (see paragraph 18 on page 5 of the originally-filed application). Also, Applicant respectfully submits that all claims that depend from these two Claims 25 and 49 are patentable for at least the same reasons as their respective independent claims.

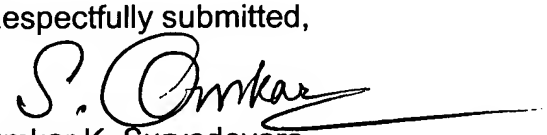
Applicant also respectfully traverses each of the Examiner's statements not explicitly discussed above. All Examiner statements in the above-identified Office Action have now been rendered moot in view of the above remarks.

The specification is amended at page 1 to supply an application number. The specification is also amended at page 14 to correct two typographical errors. Support for this amendment to the specification is found in originally-filed FIGs. 1D and 2B. See also the originally-filed specification at page 14 at lines 19-20 ("Δt is selected ...after time t2").

Applicant submits that all pending claims are now in form for allowance. Should there be any questions please call the undersigned at (408) 982-8203.

Via Express Mail Label No.
EV 581 856 085 US

Respectfully submitted,



Omkar K. Suryadevara
Attorney for Applicant
Reg. No. 36,320

SILICON VALLEY
ATENT GROUP LLP

0 Mission College Blvd
Suite 360
anta Clara, CA 95054
(408) 982-8200
FAX (408) 982-8210